THE GENERAL PLAN OF THE CHARTS

The "point statistics" of land climatology are made possible by the maintenance of weather records at fixed locations for long periods. However desirable, statistics for most ocean areas are not available to the same extent. In the past three decades, however, the Ocean Weather Station (OWS) networks maintained through the cooperation of several maritime nations have been a real step toward fixed point locations. Unfortunately, as this volume is being published, these stations are being phased out.

Beyond the coverage afforded by the 10 Ocean Weather Stations in the North Atlantic, there remain vast areas for which transient ships' logs of surface weather observations are the only source of detailed knowledge of ocean climate.

Where the number of observations is sufficient, it is possible to select areas small enough to permit an approximation to the "point statistics" of land stations. There are 50 such representative areas used in this atlas. The locations are outlined on the base chart and numbered. In a departure from the method used in the previous atlas, the graphs and tables computed for these areas have been placed on the facing page rather than on the base chart. This was made necessary by the smaller size of the published charts and also permitted a larger number of areas and more isopleth analyses.

THE OBSERVATIONS AND THEIR PROCESSING

Variations in definitions, codes and units of measurement used by maritime nations for recording and punching marine observations have resulted in 18 different forms (or "decks") of punched cards available for use at the National Climatic Center. During the past decade, most of these card decks have been placed into one tape deck in a common format. A team of meteorologists converted the units and codes in the separate decks to the common format. For a more detailed explanation of the conversion procedures, the reader is referred to the Tape Data Family-11 (TDF-11) Reference Manual (National Climatic Center, 1968). This tape deck was used in the computations in this volume. Funding for the development of TDF-11 was provided primarily by the Naval Weather Service Command with supplemental support from the Environmental Science Services Administration (now NOAA) and the Department of Defense.

The data were subjected to complex quality control procedures before processing. First, duplicate observations (identical observations which entered the data base from different sources) were eliminated. The remaining observations were then checked for internal consistency. Elements which failed to meet the internal consistency checks were either corrected or eliminated. The data were subjected to an extreme value check in which the highest and lowest values of appropriate elements were listed and checked. The duplicate elimination, internal consistency and extreme value programs are available at the National Climatic Center (National Climatic Center, 1974). These quality controlled data have been retained in a separate tape file designated as the U. S. Navy Marine Atlas Work Tapes.

Regardless of the amount of quality control to which marine observations are subjected there are inherent problems caused by the difficulty in taking observations of some meteorological elements from an unstable platform, different levels of observer experience, recording errors, variations in observing and coding practices, punching errors, and the scarcity of observations over vast areas. Another major problem is that which has been designated "fair weather bias." In recent years (the period when about half of the observations used in this volume were taken) radio communication and ship routing has been such that ships may be more frequently diverted from areas of bad weather. The apparent result has been to bias the observations which are recorded toward relatively good weather. A study by Quayle (1974) has shown this apparent bias to be quite marked for some elements when transient ship observations are compared to those from the Ocean Weather Stations. In areas removed from the OWS locations, there are different factors to consider with reference to the suspected "fair weather bias." In restricted areas such as inland seas, approaches to passes, straits and harbors, ship's masters do not have as much freedom of choice of routing and observations taken are thus less likely to be "biased." Also, it has been noted that because of less frequent occurrence of "bad" weather in lower latitudes, the "bias" toward good weather becomes less. In the tropics, there are no OWS data to be compared, but because of the relative homogeneity it is felt that transient ship data are reasonably representative.

The observations from the OWS's offer several obvious advantages to marine climatology:

1. A continuous or nearly continuous on-station record is obtained. Approximately 25 years of records are available.

2. The ships are especially equipped for weather observing.

3. Trained observers record the weather; therefore, conformity with established observing practices may be expected.

4. Observations are made at least every 3 hours, thereby permitting tabulation of duration frequencies.

5. All observable elements are regularly observed.

6. A high degree of instrumental accuracy may be expected.

7. Most positions are away from heavily traveled shipping lanes.

8. Ships are not usually under way under full power when weather observations are made.

With regard to transient ship observations, complete observations are steadily becoming more common. Ships' weather logs of past decades, incomplete by today's standards, show wind direction and speed to be the elements almost invariably recorded. From a survey of the data available for this atlas, the percentage of observations containing other basic weather elements is as follows:

Element	*Percent*
Air Temperature	97
Sea Temperature	90
Total Cloud Amount*	78
Visibility*	76
Sea Level Pressure	71
Present Weather*	64
Low Cloud Amount*	50
Wet Bulb Temperature	46
Waves*	42

*Because of incompatible observing or coding procedures, many of the observations of total cloud amount, visibility, present weather, low cloud amount, and wave data have been eliminated from the computations. This significantly reduced the percentages of these elements in the above table. The rejection of these data, unfortunately, does not eliminate the problems, but does alleviate them.

The elements in which the confidence level is not high are listed below:

PRECIPITATION – Of all of the elements recorded in historical marine observations, precipitation is one of those most subject to error in interpretation. This derives from a number of causes such as coding practices, observers' preference for certain present weather codes and fair weather bias.

SEA SURFACE TEMPERATURE – This element is recorded with a fairly high frequency in marine observations. The various methods of recording, however, tend to decrease the reliability of the individual values.